DISPLAY DEVICE AND OPERATING METHOD THEREOF

CLAIM PRIORITY

This application makes reference to, incorporates the same herein, and claims all benefits accruing under 35 U.S.C. §119 from an application earlier filed in the Korean Intellectual Property Office on 12 Apr. 2013 and there duly assigned Serial No. 10-2013-0040650.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The described technology relates generally to a display device.

2. Description of the Related Art

As a flat panel display, a liquid crystal display (LCD) and an organic light emitting diode (OLED) display are publicly known. When the liquid crystal display (LCD) and the organic light emitting diode (OLED) display employ a flexible substrate, such as a polymer film as a substrate on which a display unit is to be formed, the liquid crystal display (LCD) and the organic light emitting diode (OLED) display may have a bendable property.

The above information disclosed in this Related Art section is only for enhancement of understanding of the background of the described technology and therefore it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

SUMMARY OF THE INVENTION

The described technology has been made in an effort to provide a display device including a bendable display panel, in which a plane state and a bending state of the display panel are easily changed, a shape of the display panel is uniformly maintained in each of the plane state and the bending state, and a bending shape of the display panel is variously controllable, and a method of operating the same.

An exemplary embodiment provides a display device, including: a display panel including a flexible substrate and a display unit; and a bending adjusting member fixed to a rear surface of the display panel, and changeable between a flat state and a bending state by external force. The bending adjusting member may be bent in a width direction to form a curvature, have elasticity in the width direction and a longitudinal direction, and be maintained in any one state between the flat state and the bending state under a condition of non-application of external force.

The bending adjusting member may be bent in the longitudinal direction by first external force to be switched to the bending state, and may return to the flat state by second external force. The first external force and the second external force may have the same intensity and opposite directions.

The bending adjusting member may be disposed so that a concave surface faces the display panel, and an adhesive layer may be positioned between the display panel and the bending adjusting member.

The adhesive layer may have a stretch ratio in the width direction and the longitudinal direction of the bending adjusting member.

The bending adjusting member may be provided with at least two pairs of concave recesses in both side surfaces parallel in the longitudinal direction, and may be divided into at least three bending areas in the longitudinal direction by at least two pairs of concave recesses. Each of at least three bending areas may be independently changeable between the flat state and the bending state.

A length of the bending adjusting member may be larger than a length of the display panel, and the bending adjusting member may be provided with a pair of first concave recesses and a pair of second concave recesses at an external side of the display panel. The display panel may face one bending area positioned between the pair of first concave recesses.

The bending adjusting member may be provided with one pair of third concave recesses and one pair of fourth concave recesses at positions facing the display panel, and the display panel may face three bending areas divided by the one of the pairs of first to fourth concave recesses.

On the other hand, the bending adjusting member may be provided with one pair of first concave recesses and one pair of second concave recesses at positions facing the display panel, and the display panel may face three bending areas divided by the one pair of first and second concave recesses. The display panel may be an organic light emitting display panel.

Another exemplary embodiment provides a method of operating a display device, including: providing a display device including a bendable display panel, and a bending adjusting member fixed to a rear surface of the display panel, bent in a width direction to form a curvature, and having elasticity in the width direction and a longitudinal direction; switching states of the bending adjusting member and the display panel to a bending state by applying first external force to the bending adjusting member; and switching states of the bending adjusting member and the display panel to a flat state by applying second external force to the bending adjusting member. The bending adjusting member may be maintained in any one state between the bending state and the flat state under a condition of non-application of external force.

The first external force and the second external force may have the same intensity and opposite directions. The bending adjusting member may be provided with at least two pairs of concave recesses in both side surfaces parallel in the longitudinal direction to be divided into at least three bending areas in the longitudinal direction. The switching to the bending state and the switching to the flat state may be individually performed at each of at least three bending areas.

Another exemplary embodiment provides a display device, including: a display panel including a flexible substrate and a display unit; a bending adjusting member fixed to a rear surface of the display panel, and changeable between a flat state and a bent state; said bending adjusting member comprising; at least two pairs of concave recesses in both side surfaces parallel in the longitudinal direction: and a bending area between each pair of concave recesses and on opposite ends of the bending adjusting member in the longitudinal direction.

The switching between the flat and bent state occurs individually at each of the bending areas.

A length of the bending adjusting member is larger than a length of the display panel.

The bending adjusting member is disposed so that a concave surface faces the display panel; and an adhesive layer is positioned between the display panel and the bending adjusting member.

The adhesive layer has a stretch ratio in the width direction and the longitudinal direction of the bending adjusting member.

The bending adjusting member is bent in a width direction to form a curvature, has elasticity in the width direction and a longitudinal direction, and is maintained in any one state